Some Smaller Macropod Fossils of South Australia

J.A. McNamara
(Communicated by M.L. Augee)

South Australian Museum, North Terrace Adelaide SA 5000

McNamara, J.A. (1997). Some smaller macropod fossils of South Australia. *Proceedings of the Linnean Society of New South Wales* **117**: 97-106

Bones of *Lagostrophus fasciatus*, *Lagorchestes asomatus*, *L. leporides*, *Onychogalea lunata*, *O. fraenata*, are reported. Old records of *Caloprymnus campestris* and *Lagorchestes conspicillatus* are rejected. Juvenile material of *L. asomatus* is described and *Bettongia pusilla* sp. nov. is described from the Nullarbor.

Manuscript received 19 April 1996, accepted for publication 24 July 1996

KEYWORDS: *Lagostrophus*, *Lagorchestes asomatus*, *Lagorchestes*, *Onychogalea*, *Caloprymnus*, *Bettongia pusilla*.

INTRODUCTION

The bulk of the South Australian Museum's fossil collections are mammal bones of late Pleistocene to Holocene age. Since 1988 systematic sorting and data collation of these vertebrate fossils has yielded interesting observations. The new information generated relates to, past distributions of extant or recently extinct species, new material of rare forms and some new forms that have been brought to light, and some of it is reported here.

Sound determinations of smaller macropod taxa appear difficult but repay the effort. *Lagostrophus fasciatus*, more readily associated with southern Western Australia, may be extended with specimens from near Ceduna, the River Murray and the South East. The modern extinction of *Lagorchestes* species must be anthropogenic but may well involve synergistic stressors. For *Lagorchestes asomatus* the second skull known, first juvenile material, first South Australian record and a huge extension of range were discovered among material from the enigmatic, ?late Pleistocene Mairs Cave deposit of the Flinders Ranges. The recently exterminated *Lagorchestes leporides*, although poorly known as a living species, is present in Pleistocene and Holocene deposits in the South East, River Murray, Yorke Peninsula and Flinders Ranges. Some earlier determinations of *Lagorchestes conspicillatus* appear to be in error. *Onychogalea lunata* is recorded from the Nullarbor, Flinders Ranges and Yorke Peninsula. *Onychogalea fraenata* may now be recorded from Kangaroo Island in an apparently Holocene assemblage of mammals including *Lasiorhinus latifrons*.

Bettongia pusilla sp. nov. is described from material of Koonalda and Weekes Caves, Nullarbor Plain. It appears to be the taxon, misidentified as *Caloprymnus campestris*, sensu Lundelius and Turnbull and known informally as 'Thompson's unnamed potoroid'.

MATERIALS AND METHODS

All material referred to is part of the fossil collections held by the South Australian Museum, wherein all registered specimens bear numbers with the prefix P, or part of the mammal collections where the prefix M is used. Teeth are numbered according to my

whim, favouring a system in which adult cheek teeth of macropods are, P3 M1, M2, M3, M4, with P2 and dP3 shed earlier in life.

All measurements are in millimetres. All localities are within South Australia, unless otherwise stated. Published measurements of Finlayson's holotype of *Lagorchestes asomatus* were checked against the specimen so that the fossil material could be measured in a comparable manner.

SYSTEMATICS

Family MACROPODIDAE Gray, 1821

Bettongia pusilla sp.nov. (Fig. 1) = *Caloprymnus campestris*, sensu Lundelius and Turnbull, 1984, non (Gould, 1843)

Holotype
P35450 right dentary, juvenile with P_2, dP_3, M_1 and M_2, lacking M_3, M_4 and I_1, top of coronoid process and tip of the angular process.

Type Locality
Koonalda Cave, Nullarbor Plain, South Australia, specifically, spit 6 of trench A of the Gallus site (see Wright 1971).

Age
Holocene from faunal association, although published dates suggest the deposit may be near 20,000 years old (Thorne 1971).

Etymology
From the latin referring to its small size.

Referred Specimens
Koonalda Cave, Nullarbor Plain: P35446, right maxilla with P^2, dP^3, M^1 and M^2; P35447 part left dentary with M_2 and M_3; P35448, right dentary with I_1, P_3 in crypt and M_2 unerupted; P35449, left dentary with I_1, and M_2; P35451 right dentary with I_1, P_2 and dP_3.
Weekes Cave, Nullarbor Plain: P35442, left dentary fragment with M_3.
Old Homestead Cave, Nullarbor Plain, Western Australia: P35443 part left dentary with P_3 loose, M_1, M_2, M_3 and M_4; P35444, part left dentary with no teeth; P35445, right I_1.

Diagnosis
A small bettong with the dentary more lightly built and teeth smaller. The molars are less bulbous, more straight sided, with the crowns proportionately higher with more loph-like development than the living species of *Bettongia*. P_2 has fewer (3) cuspules and associated ridgelets, between the anterior and posterior cusps, than *B. penicillata, B. gaimardi* and *B. lesueur.* The condyle is clavate in dorsal aspect, but sub-ovoid in *Caloprymnus* and more or less T-shaped in *Hypsiprymnodon, Bettongia, Aepyprymnus*, and *Potorous*. It differs from *Caloprymnus* in being less robust, and in having, the ramus less markedly bowed ventrally, the angular process bent inward more markedly, the molars smaller and less bulbous, P_2 finer with three cuspules and ridgelets rather than just one. *B. pusilla* compares with *Hypsiprymnodon* in dentary size but its, premolars are not flared outward, diastema is shorter, ramus less bowed ventrally and it lacks the distinct hip on the posterior margin of the masseteric fossa. While it resembles *Potorous platyops* in jaw size and tooth size, it

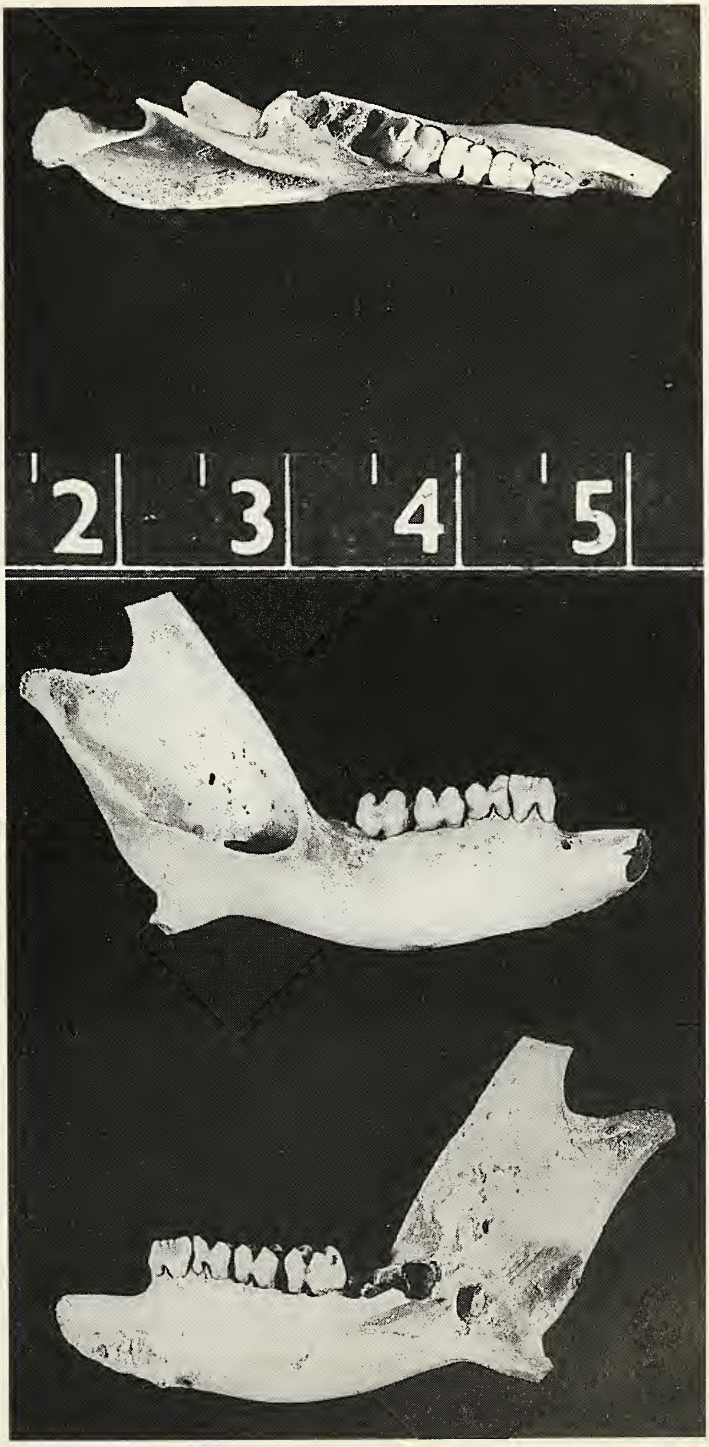

Figure 1. *Bettongia pusilla* sp. nov., holotype dentary, P35450, in dorsal, lateral and medial view, scale = 1 cm.

does not have the dentary form, with ascending ramus swept back at a low angle, the low-crowned molars, simpler premolar and primitive I_1 enamel pattern of the potoroo.

Description

The dentary (Fig. 1), 34.2 mm long, is lightly built with a short diastema of 4.6 mm and a depth under M_1 of 6.4 mm. In lateral aspect the horizontal ramus appears straight and forms an angle of 60°(with the ascending ramus. The line of the ventral margin bows downward to its lowest point below the point between M_1 and M_2. This even curve is interrupted by a slight eminence at the posterior end of the symphysis. The highest, most concave portion of the curve is below the masseteric foramen and just before the angular process which curves downward, inward and backward (to a point below the condyle in P35451). The posterior margin of the masseteric fossa is produced laterally only slightly to form a low hip before rising , in a near parallel of the anterior margin, to the condyle which is clavate in dorsal view. The coronoid process is swept back (to a point in P35451). The teeth have lengths and maximum widths of: P_2, L2.42, W1.80; dP_3, L2.41, W1.87; M_1, L2.80, W2.38; M_2, L3.24, W2.57. P_2 is a small tooth convex labially and concave lingually with a single crest formed by anterior and posterior cusps with 3 interposed cuspules and their associated ridgelets. The deciduous dP_3 is similarly small with a blade-like trigonid and loph-like talonid. M_1 is a little smaller than M_2 but both have similar form with the crown tops nearly as broad as their bases, their four cusps forming distinct protolophid and hypolophid. The type specimen has the alveoli of the remaining molars indicating an M_3 similar to M_2 and an M_4 which is smaller with a distinctly narrower hypolophid (and these may be seen as such in P35443). I_1 is not retained in the type but the alveolus indicates a smaller more slender version of the tooth seen in other bettongs. This tooth removed from juvenile dentary, P35448, has enamel on the lateral and lower surfaces and extending well down toward the open root. It does not extend as a ridge back along the dorsal lateral edge as in *Potorous*. The worn I_1, P35445, shows a remarkable extension of enamel down along the ventral edge to the root tip which is not closed, indicating an extreme hypsodont condition. I note that this tooth is a good match for the exposed alveolus of jaw fragment, P35443, allowing that they are from opposite sides of the animal.

Remarks

I am satisfied that the taxon described and figured well by Lundelius and Turnbull (1984) under the name *Caloprymnus campestris* is this taxon and note that they found 'no overlap in any measurement' (Lundelius and Turnbull 1984: 29) between their sample from Madura Cave and those quoted by other authorities. Their extensive descriptive work may be read in conjunction with this formal description of *B.pusilla*.

The name *Calopymnus campestris* should be removed from the mammalian record of the Nullarbor region until verifiable evidence is produced. Tate (1879) listed *Bettongia campestris* with a presumed native name of weelba, as a common species while he did not list *Bettognia lesueur*, which was perhaps more likely. Finlayson (1932:150) provides some evidence that 'Weelba' does not support Tate's claim. In this context three old specimens, M1705, M1706, M1710, all registered in 1922 with locality given only as SA and no collector named, are now correctly identified as *B. lesueur*, but each is branded *B. campestris*, in pencil, across the top of the skull. These indicate the possibility of early misidentification.

Lundelius (1963) lists *C. campetris* from Webb's and Snake Pit Caves but particular specimens are not identified. Archer (1974) lists *C.campestris* in the fauna of the Hampton Tableland but does not allow verification by specifying the material in question. My own brief inspection of Western Australian Museum material revealed only *B.pusilla* and no *C. campestris*. True *Caloprymnus campestris*, such as M3256 and M3257, is a distinctive form with distinctly bowed dentary with fat *Bettongia*-like molars

and cruder potoroo-like premolars. P_2 has one ridgelet and P_3 has two, whereas *B. pusilla* has 3 and 3 respectively.

Baynes is familiar with *B.pusilla* (pers.comm.) and has referred to it as 'Thomson's unnamed Potoroid' or 'Unnamed potoroid' (Baynes 1987). I consider these are one and the same. While I recognised this taxon independently in South Australia, this was at a later date than the original work by Peter Thompson (Baynes 1987) and I wish to encourage the recognition of true discoverers. I favour the use of names that relate directly to the animal and are mnemonic, and so I suggest Nullarbor Dwarf Betttong for *Bettongia pusilla*. I can see no practical purpose served by assigning this form to a new genus. I keenly await the bold cladist who may place it clearly in a diagrammatic phylogeny of the potoroids.

The ecological description of this species cannot be given at the moment, but the tantalising possibility exists that well preserved mummies may provide some of this information. Well known from some Nullarbor caves, mummies can preserve pelage, soft-tissues and gut contents. I urge the collection and proper deposition of such material.

Lagostrophus fasciatus (Péron, 1807)

Specimens

Henschke's Quarry Cave, Naracoorte, South East: P31639, right dentary; P31640, left and right maxillae and matching dentaries; P31641, right dentary; P31642, part left dentary; P31643 and P31644, part left maxillae; P31645, left, I_1; P31646, left I_1, and M_1, as loose teeth; and seven unregistered loose teeth.

Jimmy's Well, north of Tintinara, South East: P35460, right dentary.

Overland Corner Quarry, River Murray: P33474, right maxilla.

Albert Brown's Cave, Rocky Point between Ceduna and Penong, West Coast: P31647, right dentary; P31648, right dentary, juvenile; P31649; right dentary; P31650, broken skull, adult.

Charra Plains, near Ceduna, West Coast: P31651, skull and right dentary, juvenile.

Point De Mole, Gascoigne Bay, West Coast: P31653 and P31654, a pair of maxillae belonging to same skull; P31652, left dentary; P31655 and P31656, right dentaries.

Remarks

To the published archaeological evidence from the lower Murray (Wakefield 1964), an early record (Poole 1979) and one specimen reported by Flannery (1990), there can be added the hard palaeontological evidence of the existence of this species in South Australia. Its bones have been recovered from a late Pleistocene deposit (Pledge 1990) in the South East and Holocene deposits from the South East to West Coast.

This taxon may be overlooked in samples of rabbit-sized macropods. It has not been recorded from the South East (Wells and Pledge 1983) or from Henschke's (Pledge 1990). In a large sample from Henschke's Quarry Cave material, in this size range, minimum numbers of individuals of three species were found; 94 *Lagorchestes leporides* (left dentaries), 4 *Onychogalea lunata* (left dentaries) and 4 *Lagostrophus fasciatus* (left maxillae, there were 3 left dentaries). So *Lagostrophus* comprises near 5 percent of this class from that locality.

This form is easily recognised by the lower molars, with distinctive L-shaped forelink lying proud of the anterior cingulum and upper molars with prominent postlink. The skull, particularly the dentary and lower incisors, present an unusual *Sthenurus*-like facies.

Lagorchestes asomatus Finlayson, 1943

Specimens

All from Mairs Cave, Buckalowie, lower Flinders Ranges: P14513 and P35453,

skulls, juvenile; P35454, part skull, juvenile; P14516 and P35455, right dentaries; P35452, P35456, P35457, P35458, left dentaries. All specimens are juveniles with the oldest tooth-stage having the M_2 or M^2 newly erupted and P_2 or P^2 in occlusion.

Remarks

As this is the first juvenile material reported some further observations follow. The holotype described and figured by Finlayson (1943) is an adult skull with worn molars and the new fossil specimens conform closely to it. Some measurements of P14513 followed by Finlayson's measurements of the type, M3710, in brackets, for comparison are: greatest length, 62.3 (65.8); zygomatic breadth, 41.6 (42.9);nasals greatest breadth, 9.2 (9.9);diastema, 10.5 (7.1); palate length 33.7 (36.7). The usual age-related differences are noted with the older skull a little longer and higher with greater crest development, deeper zygomae and bigger bullae. A discrepancy in diastema length results from the cheek teeth being forward of the orbit by 6.1 (13.5), and of the masseteric process 9.0 (15.3). This may be explained by forward migration of the teeth, as predicted by Finlayson, and evidenced by the dentary of the holotype where M_4 is about 5 mm forward of its original position and P_3 is rotated forward in a manner characteristic of the condition found in macropodines in which tooth progression occurs without loss of that premolar.

The teeth of P14513 measure: P^2 length 4.2, width 2.5; dP^3, length 4.3, width 3.5; M^1 length 4.2, width 3.8. Compared to the type, the first cheek tooth, P^2, is shorter than P^3, Finlayson's P^4 (6.3mm), tapers more markedly, anteriorly, and the lingual cingulum is less well developed.

The juvenile skull, P14513, of *L. asomatus*, resembles that of a similiar aged skull of *L. hirsutus*, M3102, apart from the posterior breadth and depth of the former, probably associated with the greater otic development. A comparison of the teeth of these two species reveals differences. In the first, P_2 has two distinct cuspules and associated ridgelets between the anterior and posterior cusps and is longer than the corresponding tooth in *L. hirsutus*, which has just one cuspule and ridgelet. The dP_3 is more molariform, broader anteriorly with a distinct trigonid basin, whereas in *L. hirsutus* the trigonid is blade like. M_1 is similar in form but broader and higher crowned in *L. asomatus*. Of the upper teeth, P^2 is longer with 2 cuspules and ridgelets compared with one in *L. hirsutus*, and the lingual cingulum is more developed. dP^3 is broader and more molariform. M^1 is broader and higher crowned, while closely matching in form, that of *L. hirsutus*.

Initial determination and registration in 1968 as *Bettongia*, submerged this material in the South Australian Museum and Mr Merv Anderson's private collection until redetermination by the author in June 1994.

Lagorchestes leporides (Gould, 1841)

Specimens

Hereford Stream Cave, lower South East: P29143, an almost complete skull.

Unnamed Cave L106, lower South East: P29144, P29145, P29146, three near complete skulls.

Dene Kilsby's Cave, lower South East: P35596, juvenile skull.

Blanche Cave, Naracoorte, South East: P35597, skull.

Henschke's Quarry Cave, Naracoorte, South East: P17681, right dentary; P17814, left dentary; P17826, left dentary; P17798, left dentary, juvenile; P18658, part left dentary; P17626, part left maxilla; P35598 right dentary; P35599, left maxilla; P35600, P35602, P35603, left dentaries; P35604 right dentary; P35605 right dentary; P35606, left dentary; P35607, right maxilla, adult; P35608, left maxilla, juvenile; P35609, right dentary; P35610, left dentary; and a large collection of unregistered material.

Victoria Fossil Cave, Naracoorte South East; P20275, near complete skull; P25552, part skull.

Curramulka Town Cave, central Yorke Peninsula: P12921, cemented and crushed skull in two parts.
Mairs Cave, Buckalowie, lower Flinders Ranges: P35459, left dentary.

Remarks

Historical records indicate that this species was tolerably abundant in the southern settled areas of South Australia (Strahan 1983) and it is not surprising to find its fossil bones across a wide range. The name *L.* cf. *conspicillatus* has appeared on lists for the South East (Wells and Pledge 1983) but I have seen no specimens to support this. P17626 was registered as *Lagorchestes* cf. *conspicillatus* in early 1972, and indicates a possible source of confusion. The label was amended to '*leporides*' at some time but the register entry was not corrected until this year when the number was assigned to a single specimen, previously several unnumbered specimens of mixed taxa were together under the one label. Two teeth of *Macropus rufogriseus* were removed during a later phase of sorting, probably 1989–90. *Lagorchestes*, P17814 registered later in 1972, was not given a specific identification and was subsequently sorted as one left dentary of *L. leporides*, bearing the number and one left dentary of *Onychogalea lunata* now numbered P35470. Confusion of similar sized taxa is discussed elsewhere. Uncertainty was not confined to the Henschke's material, P20275 from Victoria Cave is still registered as *Largochestes*? [*sic*] only. In the absence of supporting evidence, *L. conspicillatus* should be struck from the fossil record of South Australia.

Onychogalea lunata (Gould, 1840)

Specimens

Henschke's Quarry Cave, Naracoorte, South East: P35467, left maxilla; P35468, part right maxilla; P35473, part left maxilla with P^3, M^1, P35469, left dentary, juvenile, P35470, left dentary, juvenile; P35474, part left dentary, and some unregistered loose teeth.
Curramulka Town Cave, Yorke Peninsula: P35466, right dentary.
Corra Lynn Cave, Curramulka, Yorke Peninsula: P35464, juvenile skull, left dentary and some associated post-cranial bones.
Baldina Creek, near Burrra: P35465, complete juvenile left dentary with P_3 exposed in crypt.
Dempsey's Lake, Port Augusta: mostly fragmentary material including, P19470, P19493, P35484, P35486, P35487; and more complete dentaries, P22488 and P35485.
Mairs Cave, Buckalowie, Southern Flinders Ranges: P35461, right dentary juvenile; P35462 part right dentary, juvenile.
Koonalda Cave, Nullarbor Plain, (Gallus site): P35476, P35477, P35478, P35479, P35480, P35482, P35483, dentary fragments; P35481, part maxilla.
Purple Goringe Cave, Nullarbor Plain, Western Australia: P35463, mummified upper thorax with skull and right dentary.

Remarks

Poorly known as a living animal *O. lunata* seems to have favoured the drier northern and western regions and this is reflected in the occurrence of its bones from the Nullarbor to the Flinders Ranges. If we can say anything definite about the ecology of this species, its presence in Pleistocene deposits of the South East, may indicate that these samples record, at least in part, a drier episode of regional climate.

This species was overlooked in samples of rabbit-sized macropods, as noted elsewhere, or simply misidentified. Although its arched tooth-rows, elegantly flaring molar crests and lophs and vestigial premolars should distinguish it and the following species. It was not distinguished in various South Australian Museum samples, and Williams (1982) tentatively discussed material of this and the following species under the heading of *Macropus eugenii.*

Onychogalea fraenata (Gould, 1841)

Specimens

Kelly Hill Caves, Kangaroo Island, P35491, skull; P35492, part skull; P35493, left and right maxillae; P35494, left maxilla; P35490, left maxilla; P35495, P36496, P35497, P35498, P35499, P35500, dentaries.

Lake Fowler, Southern Yorke Peninsula: P18918, left maxilla; P18919, part left maxilla; P18920, right dentary with P_3 excavated.

Baldina Creek, near Burra: P35488, right maxilla; P21023, part left maxilla; P21090, part left dentary; P22458, part left dentary.

Dempsey's Lake, Port Augusta: P18243, P19426, P19469c, fragments with teeth.

Remarks

Some comments for the preceding species apply here, although *O. fraenata* still allows ecological study of populations in a tiny part of its former range.

This report seems to include the first record of the species for Kangaroo Island, where its remains were mixed with those of *Lasiorhinus latifrons*, now extinct on the Island, too, but well entrenched on the mainland where it has been well studied ecologically.

We have evidence of coincidence of the two *Onychogalea* species from the lower Flinders Ranges area, but as usual with fossil deposits this should not be taken as proof of synchrony and, therefore sympatry.

DISCUSSION

The purpose of this paper is to report the results of sorting and systematic reorganisation of about half the South Australian Museum fossil mammal bone material. Reports of fossils are all too often associated with speculative interpretation of biological, ecological and climatological implications. I can only indicate the potential there may be for such information to be gleaned from the Quaternary deposits of South Australia. If reliable determinations of well curated specimens can be married to sound stratigraphies with secure, consistent dates of actual bone material and then considered together with a deeper ecological understanding (if it can be gained from the remaining rabbit-sized macropods), this may allow detailed explanation of the Pleistocene and Holocene climate changes as they affected this continent. However, trying to survive as a museum palaeontologist in an environment increasingly influenced by adverse financial and intellectual conditions, one should perhaps be content with the modest and achievable goal of completing the second half of the sort. One hint of what might be undetected is provided by specimen M1828, associated with labels suggesting that it was collected in October 1872 by F.W. Andrews in sandhills near Lake Gairdner — it is a skull of *Setonix brachyurus*.

ACKNOWLEDGEMENTS

I wish to express my appreciation to all those who collected bone material and lodged it at the South Australian Museum, including: Peter F. Aitken, Merv Anderson, Fred W. Aslin, Albert H. Brown, Cave Exploration Group of S. Aust. Inc., A. Gallus, C. Hales, P. Harper, W.A. Head, Ken Heynes, Jack Howard, J. MacLucas, J. Miekel, H.W. Moeller, G. Pilkington, N.S. Pledge, Ron Simms, D.J. Taylor, A.E. Vigar, Dom L.G. Williams and Adam Yates. The gestation of a scientific contribution requires a certain sequence of events, these people were the vital initiator, without whom there would be no knowledge gain. Unlike the biological model, timing in science is not so definite and in one case, forty years does not seem over long. My thanks to Lynette Queale for bringing the *Setonix* skull to my attention, Robyn Cherrington and Lucy Ramsden for typing and Trevor Peters for photography.

REFERENCES

Archer, M. (1974). New information about the Quaternary distribution of the thylacine (Marsupialia, Thylacinidae) in Australia. *Journal of the Royal Society of Western Australia* **57,** 43–50.

Baynes, A. (1987). The original mammal fauna of the Nullarbor and southern peripheral regions: evidence from skeletal remains in superficial cave deposits. In 'A biological survey of the Nullarbor Region South and Western Australia in 1984' (Eds N.L. McKenzie and A.C. Robinson) pp. 139–52, 401–2. (S. Aust. Dept. Environment and Planning: Adelaide).

Finlayson, H.H. (1932). *Caloprymnus campestris*. Its recurrence and characters. *Transactions of the Royal Society of South Australia* **56**, 148–167.

Finlayson, H.H. (1943). A new species of *Lagorchestes* (Marsupialia) *Transactions of the Royal Society of South Australia* **67**, 319–321.

Flannery, T.F. (1990). 'Australia's vanishing mammals'. (RD Press: Surry Hills).

Lundelius, E.L. (1963). Vertebrate remains from the Nullarbor Caves, Western Australia. *Journal of the Royal Society of Western Australia* **46**, 75–80.

Lundelius, E. L. and Turnbull W.D. (1984). The Mammalian Fauna of Madura Cave, Western Australia Part IV: Macropodidae: Potoroinae. *Fieldiana* : Geology New Series, No 14.

Pledge, N.S. (1990). The Upper Fossil Fauna of the Henschke Fossil Cave, Naracoorte, South Australia. *Memoirs of the Queensland Museum* **28,** 247–261.

Poole, W.E. (1979). Australian Kangaroos. In 'The Status of endangered Australasian Wildlife'. Proceedings of the Centenary Symposium (Ed. M.J. Tyler) pp 13–27. (Royal Zoological Society of South Australia: Adelaide).

Strahan, R. (ed) (1983). 'The Australian Museum Complete Book of Australian Mammals' (Angus and Robertson: Sydney).

Tate, R. (1879). The Natural history of the country around the head of the Great Australian Bight. *Transactions Royal Society South Australia* **2**, 94–128.

Thorne, A.S. (1971). The Fauna. In 'Archaeology of the Gallus site, Koonalda Cave'. Australian Aboriginal Studies No. 26, Prehistory Series No. 5 (Ed. R.V.S. Wright) chap. 5. (Australian Insitute of Aboriginal Studies: Canberra).

Wakefield, N.A. (1964). Appendix 1 Mammal Remains. In 'Archaeological excavation of rock shelter No. 6 Fromm's Landing, South Australia' (Eds D.J. Mulvaney, G.H. Lawton and C.R. Twidale) pp 494–498. *Proceedings of the Royal Society of Victoria* **77**.

Wells, R.T. and Pledge, N.S. (1983). 16 : Vertebrate Fossils. In 'Natural History of the South East' (Eds M.J. Tyler, C.R. Twidale, J.K. Ling and J.W. Holmes) pp. 169–176. (Royal Society of South Australia Inc. :Adelaide).

Williams, D.L.G. (1982). Late Pleistocene vertebrates and palaeoenvironments of the Flinders and Mount Lofty Ranges, South Australia. (Unpublished thesis, Flinders University, School of Biological Sciences: Adelaide).

Wright, R.V.S., ed. (1971). The archaeology of the Gallus site, Koonalda Cave. Australian Aboriginal Studies No. 26, Prehistory Series No. 5. (Australian Institute of Aboriginal Studies: Canberra).